Biosecurity Plan

Indian Trail Hatchery

2009

Hatchery Manager — Date 12/1/09

Aquatic Animal Health Specialist — Date 12/1/09

Hatchery Systems Manager — Date 12/1/09

Introduction

Indian Trail Hatchery is located in Dent County, 12 miles northeast of Salem, Missouri on Route 19. Constructed by the CCC between 1936 and 1942, the hatchery occupies about 85 acres in Indian Trail Conservation Area (Figure 1). The hatchery grounds are surrounded by a 275-acre wildlife refuge. The hatchery complex consists of a hatchery building, shop/storage building and 11 acres of ponds (Figures 1 and 2). Water supply is supplied to the facility from Blackwell Lake by gravity flow through an eight inch pipe. MDC owns most of this lake's watershed and the remaining area outside of MDC control is undeveloped land.

Except for Pond 1, which is triangular, each pond is rectangular in shape and approximately 1 acre in size (Figure 2). At the shallow end of each pond is a water inlet structure which allows the pond to be filtered while filling to eliminate small fish and insects. At the deep end of each pond is a screened drain structure where boards are utilized to control the water level during draining.

The hatchery building is 1,920 square feet and receives water from Blackwell Lake by gravity flow through a four inch line. Fifteen tanks/raceways are located in the building. They consist of: four - 22' x 4' x 2.5 (220 ft^3) concrete raceways; one - 19.5 x 3.83' x 2.5' (187 ft^3) concrete raceway; two -14.5' x 3.83 x 2.5' (139 ft^3) concrete raceways; and eight – 9' x 183' x 1 (16.47 ft^3) fiberglass holding tanks. Water exiting the building drains into pond one (Figure 3).

Indian Trail (IT) was taken out of full production in 2007. Labor and management are currently supplied by the Maramec Spring Hatchery staff. The hatchery is now used primarily as a transfer station for the private impoundment program (PIP) and southeast Missouri lake stockings. Largemouth bass, bluegill and channel catfish are received primarily from Hunnewell and Chesapeake hatcheries for transfers. For PIP, hatchery personnel from Indian Trail maintain the PIP database, send letters, set up schedules and deliver fish over a two week period. Fish are held in the IT hatchery building during this time. Indian Trail is currently stocking thirty counties or 27% of 114 Missouri counties (Camden, Maries, Gasconade, Osage, Phelps, Crawford, Franklin, Jefferson, Dent, Washington, Ste. Genevieve, St. Francois, Iron, Reynolds, Wayne, Butler, Carter, Stoddard, Pemiscot, Dunklin, New Madrid, Mississippi, Bollinger, Cape Girardeau, Perry, Madison, Shannon, Oregon, Ripley and Scott.)

On-site, one pond houses a mixture of fish species for display at fairs. Eight ponds contain fathead minnows. No other species are maintained year-round.

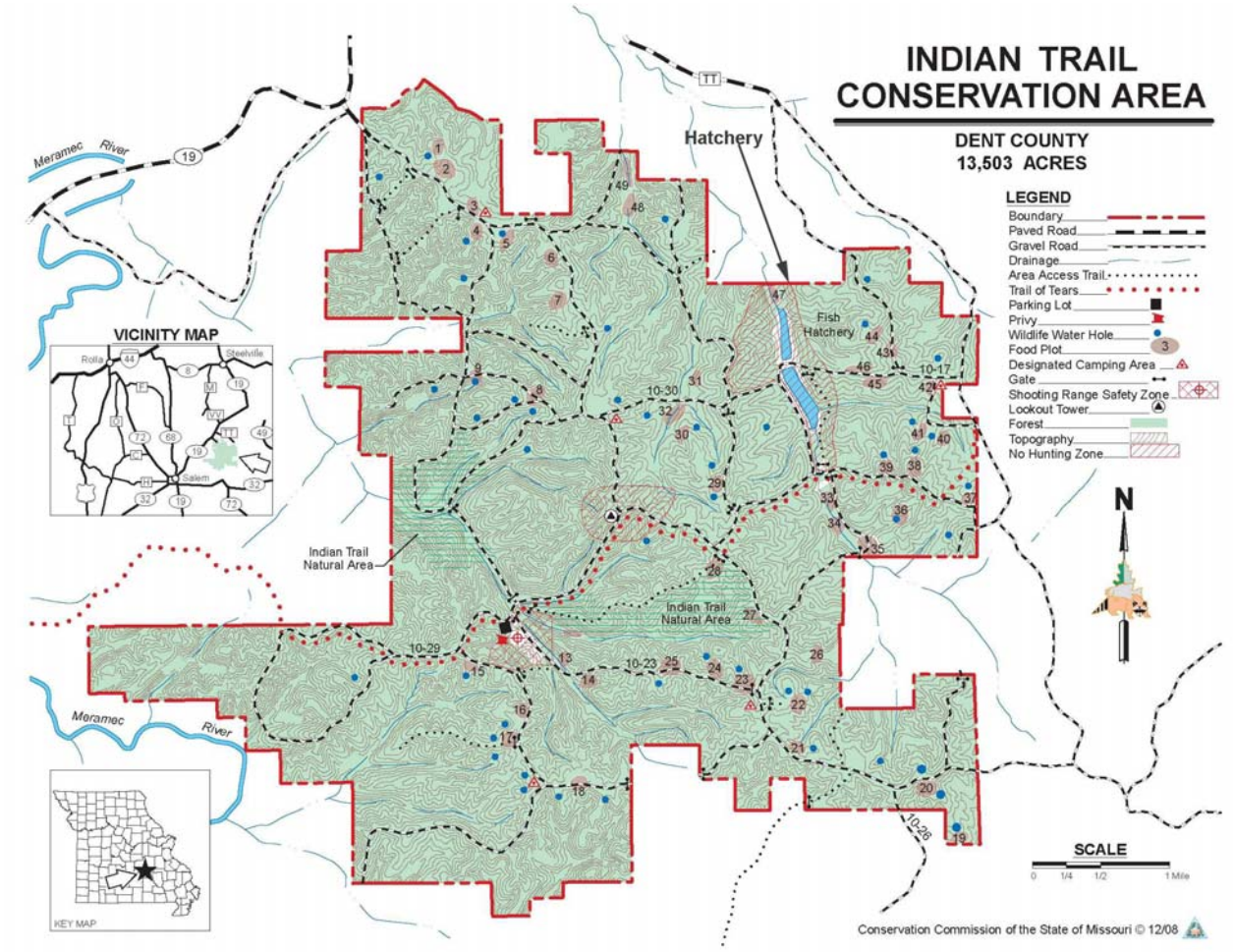


Figure 1. Indian Trail Conservation Area and Fish Hatchery.

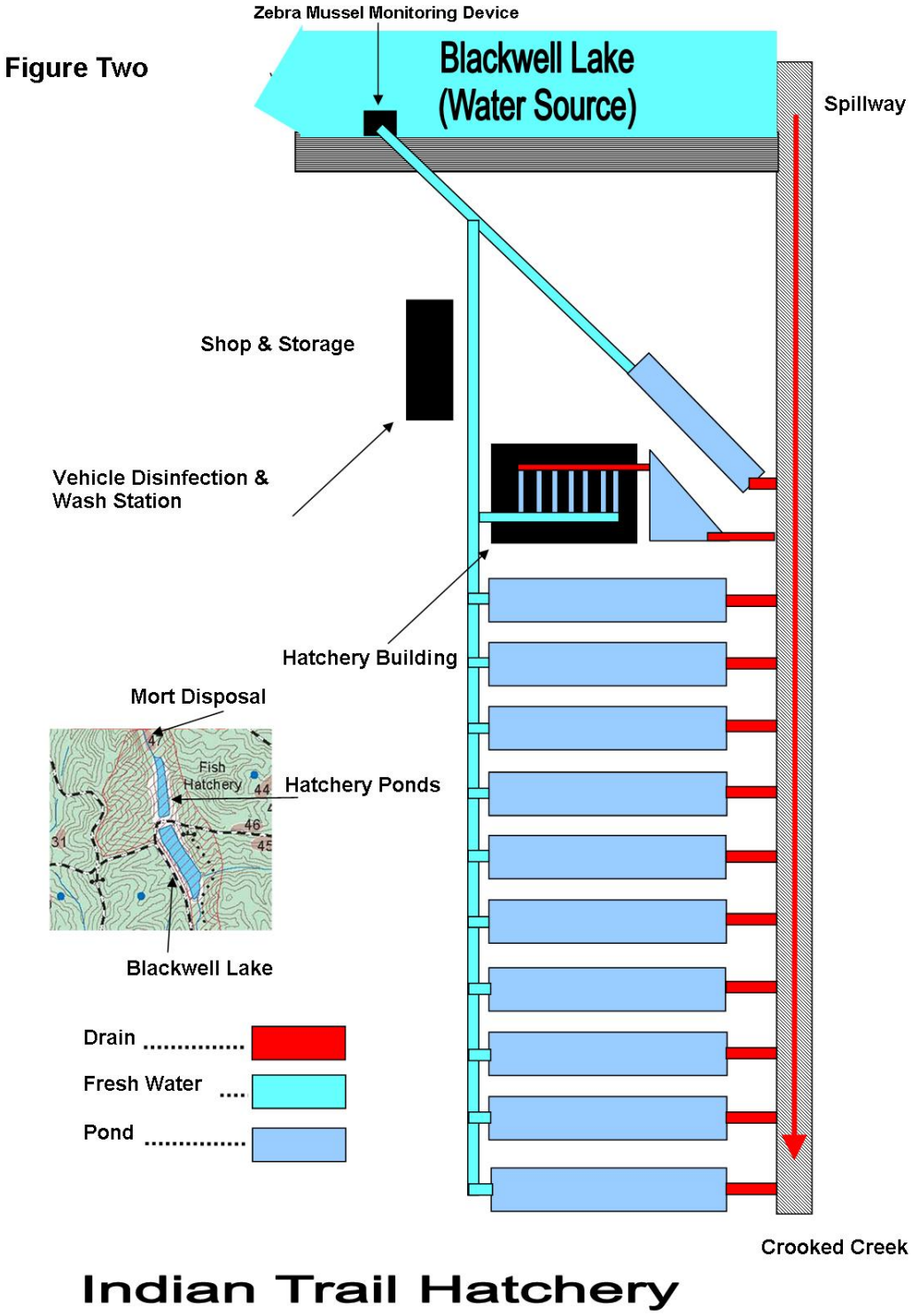


Figure 2. Pond layout and water distribution pattern through Indian Trail Hatchery.

Figure 3. Hatchery production room.

The primary purpose of this plan will be to provide guidelines to address biosecurity concerns which currently exist. These include: 1) the transfer of pathogens from another facility via fish that are held in the facility prior to stocking; and 2) the threat of zebra mussels or another aquatic nuisance species or pathogen introduced through the association with bait used by the public for fishing in Blackwell Lake or in any of its surrounding watershed impoundments.

Because the future use of this facility is pending further curtailment, this plan may be modified accordingly.

General Equipment Use and Cleaning

Background: A variety of equipment is used at Indian Trail Hatchery. Equipment and human hands are recognized as modes for pathogen transfer. Viruses, bacteria and parasites are invisible to the naked eye so their transmission via objects goes easily unnoticed. Information on commonly used disinfectants is provided in Appendix; Attachment 3 for general reference.

Examples of common equipment items are listed below.

- Personal protective equipment: e.g., waders, hip boots, rubber boots, raingear, gloves.

- Work equipment: e.g., dip nets, buckets, brooms, brushes, sponges, towels, automatic feeders, aerators, water pumps, weighing scales.

- Vehicle equipment: e.g., fish trucks, pick-up trucks, boats and boom trucks.

Highest Risks

Pathogens: bacterial, viral, parasitic and aquatic nuisance species.

General Guidelines

1. The sharing of personal protective and work equipment between fish hatcheries is discouraged. Guest workers at fish hatcheries should be provided personal protective equipment to use during their visit. This equipment shall stay at this site. If on the rare occasion that there is not enough equipment available for guests and they must bring their own, these items should be thoroughly disinfected before and after use on-site.

2. Equipment and vehicles will be cleaned outdoors next to the shop (Figure 2).

3. During cleaning the layers of fish slime, mud or organic debris will be removed first through brushing, hosing or power washing, then they shall be soaked or sprayed with disinfectant.

4. Porous materials, such as wooden handles on dip nets, shall be eliminated and replaced with non-porous materials such as fiberglass or metal. If sponges or cloth towels are used, they shall be clean, changed daily or disinfected after each use.

5. Virkon® Aquatic is the disinfectant of choice because it is approved for use in aquaculture and is environmental friendly.

6. The potency of reconstituted disinfectants shall be tested at least once every 4 days with test strips. If it has evaporated or the active ingredient level is less than the recommended strength, it shall be refreshed or replaced with new disinfectant.

Vehicle Disinfection

1. If fish transport trucks are sent off-site to deliver or move fish they will be power washed and disinfected either en-route back to the hatchery of origin or at the designated cleaning site by the shop (Figure 2). They shall not be used for any additional loads unless they are disinfected. Proper disinfection shall include power washing followed by Virkon® Aquatic 0.5% sprayed inside the holding tank, on nets and through hoses. External surfaces may be further cleaned with 200 ppm chlorine bleach. After disinfection, all equipment will be thoroughly rinsed with clean water.

Fish Transfers

Background: At Indian Trail Hatchery, “wild” origin fair fish are maintained and taken off-site for display about three times a year. Otherwise, only largemouth bass and bluegill are brought to Indian Trail Hatchery from Chesapeake and Hunnewell hatcheries. Since IT has no fish truck of its own, all vehicle equipment used to stock the fish come from Maramec Spring Hatchery. Fish are stocked into public waters or placed in recirculating aquarium systems for display. Pathogen transfer may occur during these transfer activities.

Highest Risks

Aquatic nuisance species and pathogens (parasitic, bacterial, viral)

Transfers from non-MDC hatcheries

1. Before a shipment of fish shall be received from a non-MDC fish hatchery, the shipper shall submit a current fish health inspection for review and issuance of an import permit (if necessary).

2. In addition to inspection of this report, the hatchery manager shall ask the hatchery manager or other shipper to complete and return via FAX or email a "Fish Transfer Information Sheet" along with mortality records for the previous 15 days (Appendix; Attachment 2). This sheet will help us identify in writing any other pathogens/nuisance species not specified on the health inspection record which may occur in their watershed or hatchery. This would include things like other viruses, parasites, zebra mussels, New Zealand mud snails, quagga mussels, rusty crayfish or parasitic copepods.

3. All equipment used during the off-loading of these fish shall be immediately disinfected after use.

Transfer of fish between MDC hatcheries

1. Three (3) days prior to the transfer of fish between MDC hatcheries, the shipping facility shall FAX or email to the Indian Trail hatchery manager, a copy of the sending unit's mortality record which shall cover the previous 15 days. In addition, comments shall be made regarding the lot's general history, past chemical therapies and notes of any abnormal behaviors observed by completing a "Fish Transfer Information Sheet" (Appendix; Attachment 2).

2. In the event that Maramec Spring/Indian Trail hatchery trucks are used to

Wild Fish Transfers

1. All fish caught from the wild and transported to an MDC hatchery shall be treated for Zebra Mussels per MDC policy (Appendix; Attachement 1):

   -750 ppm KCL for 1 hour, then 25 ppm formalin is added for an additional 2 hours; and
   -Total treatment time is 3 hours.

2. When possible, hatchery vehicles will be used to transport fish rather than stock tanks or livewells from regional Fisheries staff.

3. At this time, no wild fish should be brought into the facility from sources having known zebra mussel populations.

4. Only healthy fish will be utilized for broodstock or other similar purposes.

5. All equipment used on wild fish will be thoroughly disinfected with Virkon® Aquatic after use. Any vehicles used to transport wild fish will similarly be cleaned and disinfected after use.

Treating Sick Fish

Background: When disease outbreaks occur in a rearing unit the risk of spreading this pathogen to other rearing units increases. Our goal is to isolate this "sick" unit as much as possible. Each pond except Pond 1 is single pass so each outdoor pond may be considered a seperate isolation unit.

Highest Risk

Spreading pathogens to other rearing units on-site.

General Guidelines

1. The cause of the increased mortality shall be identified through necropsy, skin scrape, gill biopsy, clinical signs, bacterial or viral culture. It shall then be treated appropriately.

2. Units of sick fish will be considered as "quarantine areas" and specific equipment shall be dedicated for their use only. This equipment will be

disinfected and stay at that site.

3. All equipment coming in contact with these fish and unit shall be immediately disinfected with 0.5-1% Virkon® Aquatic.

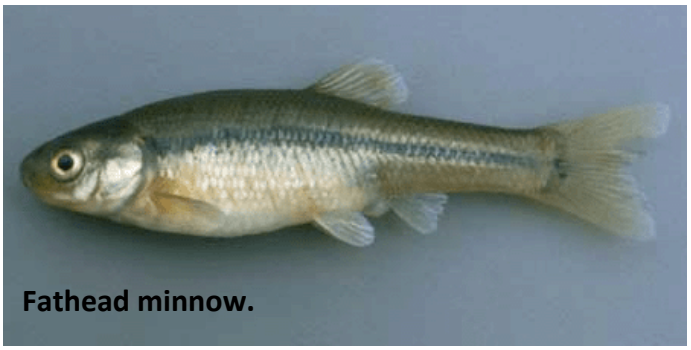
4. A minimum number of people shall work with these fish.

5. After any contact with these fish or water (e.g., picking up mortalities, brushing raceways), staff shall wash hands with soap and water or use a hand sanitizer.

Broodstock Management

Background:

At the present, Indian Trail hatchery only has fathead minnow broodstock that are held and maintained on site. These fish are spawned extensively in rearing ponds.



Fathead minnow.

Highest Risk

Viral pathogens
Bacterial and parasitic infections

General Guidelines

At the time of spawning staff will select only apparently healthy fish for spawning. In particular, fish with poor body condition, ulcerated skin, hemorrhagic skin, darkened skin, exophthalmia, a hemorrhagic vent or very pale gills shall be culled from the breeding population.

General Sanitation

Background: The maintenance of a high standard of general sanitation is a proven method for minimizing disease outbreaks in both human and veterinary practices. At Indian Trail Hatchery, we have identified the following areas for general sanitation: (1) handling of fish mortalities from rearing units; (2) cleaning of rearing units between lots; and (3) cleaning tanks and hatchery building floors. Information on commonly used disinfectants is provided in Appendix; Attachment 3 for general reference.

Highest Risks

1. Bacterial pathogens in dead fish are at peak levels; therefore their handling can be considered a serious mode of disease transmission.

2. Parasites and bacterial pathogens may be transmitted in water and/or fish waste products.

3. Bacterial and viral pathogens may contaminate hands, floors and equipment in areas where sick fish are necropsied.

Fish Mortality Sanitation

1. Specific equipment (e.g., nets and buckets) shall be designated for picking up dead fish. Buckets and nets used for this activity should be prominently labeled and not be used for any other activity. When mort buckets are placed in vehicles they shall be set in a secondary pan containing 1-2" of Virkon®. This will allow the bottom of the bucket to be constantly disinfected while in use and it will help prevent water and slime from contaminating the bed of the vehicle.

2. A large bucket containing Virkon® Aquatic at 1-2% should be available for soaking nets between uses. Ideally, while a net is being used another one can be soaking for at least 5 (2%) -10 (1%) minutes before it is used again.

3. Mortalities will be removed weekly from rearing units. Mortalities shall be taken to an unfenced "mort pit" area located near the lower end of the hatchery area for burial (Figure 2).

4. Personnel shall wash their hands with soap and water or use hand sanitizer after collecting and disposing dead fish. Hand sanitizers shall be conveniently placed in vehicles.

5. The vehicle used to transport the dead fish shall be hosed out at the designated equipment cleaning area at least once weekly and disinfected.

More frequent cleaning will be warranted if mortalities are high or there is spillage from buckets on to the bed of the vehicle.

Fish Handling and Aquatic Equipment

1. The truck washing station is currently located at the shop area (Figure 2).

2. Some fish harvest equipment and material will be stored and used at the hatchery building. Other harvest equipment from Maramec Spring Hatchery will be utilized. This shared equipment will be disinfected between uses.

Cleaning Rearing Units

1. Between lots of fish, rearing units shall be dewatered completely when possible.

2. Indoor tanks will be washed with a brush, sprayed with Virkon® Aquatic 0.5% and then allowed to dry before next use. If no chemicals are permitted, steam spraying for 5 minutes is recommended. Salt may be used as an abrasive.

3. When possible, each tank or set of tanks shall have its own net and brush. If nets or brushes are shared, they shall be appropriately disinfected between uses for 10 minutes.

4. Floors of the production room shall be mopped with a disinfectant if an outbreak of disease causing high mortality is occurring. Otherwise, it shall be power washed or hosed down (if power washing access is not possible) once every 2 weeks during periods of high use and mopped with a disinfectant.

Public Use

Background: The Indian Trail Hatchery complex is closed to the public. Although visitors will use Blackwell Lake in the future, there is no entry to the buildings and ponds. The area is fenced off and has a locked gate.

Wildlife frequenting the hatchery includes a variety of mammals and birds that prey upon live and dead fish captured from the ponds. Wildlife not only prey upon fish but can also transfer diseased fish from one area to another and regurgitate partially eaten food. They are considered as disease vectors and their activities are largely beyond human control.

Highest Risks

Humans

Aquatic nuisance species introduction or disease transmissions from bait bucket releases in the water supply lake are the greatest threats from humans. Regulations will prohibit bait buckets with water. Signs will be placed in the parking lot educating visitors to the regulations of the area and associated bio-security.

Wildlife

1. Mechanical transfer of diseased fish or aquatic nuisance species.

General Guidelines-Humans

1. Where possible, fish at greatest risk of disease (youngest fish or most sensitive species) should be located as far away from frequent foot traffic as possible.

2. Visitors will continue to be restricted to areas away from the hatchery grounds.

3. Educating the public about disease and invasive specie transfer risks during fishing trips will be included in parking lot signage.

General Guidelines-Wildlife

The following steps may be taken to discourage nuisance wildlife residence at Indian Trail Hatchery:

1. Fish mortalities from ponds and indoor units will be disposed of in a pit away from the hatchery complex and dead fish will be covered with dirt upon disposal. (Figure 2)

2. Nuisance animals will be controlled with the use of traps and bird depredation permits.

3. Feed storage areas will be kept clean.

General Disease and Aquatic Nuisance Species Surveillance

Background: Implementation of a surveillance program will provide a means of detecting the presence of aquatic nuisance species and pathogens for early intervention and help provide bench marks for eradication measures.

Highest Risks

1. Viral pathogens: VHS, CCV, LMBV,
2. Parasites: Ich, trematodes, *Trichodina, Costia, Chilodonella, Epistylis*
3. Bacteria: *Edwardsiella ictaluri, Aeromonas* spp.
4. Aquatic nuisance species suc as zebra mussel, New Zealand mud snails, quagga mussels, etc.

General Guidelines

Good staff education is the number one preventive measure for disease surveillance. Education will provide a means for staff to recognize problems and take steps to correct them.

1. Recommend that each staff member take the Introduction to Fish Health class provided by MDC.

2. If there is interest, the MDC Aquatic Animal Health Specialist will be available to provide additional on-site training or refreshing of fish diagnostic techniques.

3. Artificial substrates consisting of layers of discarded plastic signs for detecting zebra and quagga mussels will be placed in designated areas in the hatchery water system and Blackwell Lake for visual monitoring. (Figure 4).

Figure 4. Artificial sampler new and covered with zebra mussels 7 months after placement in a body of water positive for zebra mussels (from Brian McKeage, MDC).

4. The MDC Aquatic Animal Health Specialist will conduct fish health testing for viruses and bacteria on an as needed basis until a firm policy is established by Fisheries Leadership.

5. Fish displaying abnormal behaviors (going off feed, changes to skin color, reddened fins, increased mortalities, etc.) will be promptly evaluated (at a minimum, by general external appearance, skin scrape and gill biopsy) on-site and treated appropriately. If initial therapy is unsuccessful or if additional tests are needed which are not available on-site (e.g., bacterial culture, histopathology), they will be referred to the MDC Aquatic Animal Health Specialist for further evaluation.

6. Mortality records in writing will be maintained on a daily basis for each rearing unit. Periodically, these records will be sent to other fish hatcheries during fish transfers and will provide a means of monitoring fish health.

Summary

Indian Trail Hatchery has gone from a full production category to a limited use status. Geographically located in the southeast corner of the state and having a substantial portion of the watershed under MDC control makes the hatchery an ideal place for a transfer station. Overall, the biosecurity risks at this facility are very low because of its geograph ical isolation and no public access (except to the Lake). The greatest threat may be contamination from the water supply by anglers and the use of shared equipment that is needed to harvest ponds. One of the most important parts of this plan will be to ensure that trucks and equipment are disinfected after use. The hatchery, although aging, is in a unique position to help the warm-water system especially in the realm of biosecurity. Stone lined ponds are excellent for forage production. If this capability were utilized, MDC could limit the number of fish that would otherwise be purchased outside the system. Some suggested uses include the rearing of species such as hellbender and mussels. Indian Trail may also contribute by quarantining other wild fish such as shovelnose sturgeon and lake sturgeon that could be used in research projects or for housing all fair fish, thus removing this biosecurity risk from other larger facilities like Lost Valley and Chesapeake hatcheries.

Appendix. Attachment 1.

ZEBRA MUSSEL PREVENTION

POLICY

The Missouri Department of Conservation will work to prevent the spread of zebra mussels from infested waters to uninfested waters.

Est. 10/05

PROCEDURES

● RESOURCE THREAT

Zebra mussels can clog power plants, industrial and public drinking water intakes, foul boat hulls, decimate populations of freshwater mussels and other native aquatic organisms, impact fisheries and disrupt aquatic ecosystem functions. Economic impacts of zebra mussels in North America are estimated to be in the billions of dollars.

Because of the ease with which microscopic larval zebra mussels may be transported by the public, it may take several years to detect an infestation. Avoiding known infested areas, or staging equipment use such that waters known, or suspected to be infested, are visited last, will help prevent the spread of zebra mussels. However, boats, equipment, and gear must be decontaminated prior to use in different waters. Personnel will take reasonable precautions to avoid exposure of equipment, facilities, and other waters to zebra mussels.

● PUBLIC OUTREACH AND EDUCATION

Increased public outreach and education will enhance understanding of the potential problems associated with zebra mussels and the measures that may help deter their expansion. Signs should be posted at all MDC owned and managed boat ramps highlighting the potential problems associated with zebra mussels. Information should be distributed through our state, federal and non-governmental agency partners, MDC managed waterfowl areas, trapping associates, sport fishing groups, marinas, lake associations, Department offices and Nature Centers, media outlets and to other water users in Missouri.

● EQUIPMENT DECONTAMINATION PROCEDURES

Appropriate safeguards to prevent the transfer of zebra mussels from one waterbody to another are mandatory and include inspection, treatment, and, if possible, avoidance. The following steps detail equipment decontamination procedures:

1. Thoroughly inspect boats (hulls, drive units, trim plates, transducers), trailers and components (rollers, bunk boards, axles, etc.), equipment (i.e., water pumps, hatchery equipment, siphons, nets, ropes, traps, etc.), and machinery (tractors, bulldozers, etc.) for adult zebra mussels. Pay close attention to nooks, crannies and other inconspicuous places (i.e., around the motor housing, trim tabs, and water intake screens, or pump fittings). All trash, mud, vegetation, and suspected zebra

mussels should be removed and properly disposed of in the trash. Immediately report suspected occurrences of zebra mussels to the Invasive Species Coordinator. Carpeted bunks and runners on existing boat trailers should be replaced with poly, plastic or wooden bunks as soon as practical; boat trailers regularly moved between known zebra mussel infested waters and other waters should have carpeted bunks and runners replaced immediately. As available, future boat trailers should be purchased with poly/plastic/wooden bunks.

2. All water should be drained from boats, trailers, motors, live wells, bilges, transom wells, holding tanks and live wells, water pumps, pipes, and other equipment prior to leaving a waterway. Pay particular attention to boat hulls under installed decking. Drain as much water as possible from equipment such as lower motor units and portable pumps.

3. Any boat, trailer, tank, equipment, machinery, gear, or net transferred from one body of water into a different body of water or from known infested waters to potentially infested waters must be decontaminated using one of the treatments in Table 1 prior to being used in a new body of water. Equipment decontamination procedures should be completed when moving equipment from infested areas of a water body to uninfested areas of the same water body.

If boats, nets, and other equipment are only used in one body of water, cleaning between uses is not necessary, but these boats, nets, and other equipment MUST be clearly labeled for use in that body of water ONLY. Periodic cleaning and decontamination (i.e., during winterization or other maintenance) should be conducted to prevent costly repairs. If management or research activities require this equipment to be moved in the future, decontamination procedures will be implemented.

● HATCHERY PRECAUTIONS

Best management practices should be used to protect equipment and facilities and to reduce the opportunity for the spread of zebra mussels to uninfested areas. Introductions of zebra mussels into MDC fish hatcheries or water supply sources would have devastating impacts upon hatchery infrastructure. If infested, hatcheries would then be a possible mechanism for transporting the organisms to uninfested waters.

Therefore, the following precautionary measures will be enacted by MDC fish hatcheries:

1. All attempts will be made to secure fish from sources known to be free of zebra mussels (veligers and adults) (see map at http://intranet/Documents/17407.pdf)

2. All fish and eggs exposed to surface water coming into or leaving any of MDC's hatcheries or other facilities and any fish procured through contract or other means from outside sources must be treated during transportation using one of the treatments in Table 3. The only exception will be for fish that are stocked into the same water supply that is used by the hatchery (e.g., trout stocked in Bennett Spring branch by Bennett Spring Hatchery staff) and for selected species of conservation concern.

3. Specific limitations may be applied to native mussel and hellbender culture, and other species of conservation concern, on a case-by-case basis.
4. Some species or life stages of fish or other aquatic organisms may be less tolerant of chemical treatments. For these species or life stages whose chemical tolerances are unknown, bioassays must be performed prior to large scale use of the prescribed treatments listed below. Until these bioassays are conducted, brood stock of these species will only be obtained from waters known to be free of zebra mussels.

Table 1. Zebra Mussel Disinfectants and Usage Guidelines for Boats and Equipment

Disinfectant	**Concentration**	**Contact Time**	**Usage Guidelines, Safety Precautions, Drawbacks**
Vinegar	100%	20 min	Use appropriate personal protective equipment (PPE) and caution. Stay upwind of the spray. Is corrosive to metal and toxic to fish at this concentration, so thoroughly rinse with tap water or water from the next lake or river after disinfection. Ensure that solution does not run-off directly into waterways.
Chlorine	200 ppm	10 min	Use appropriate PPE and caution. Stay upwind of the spray. Is corrosive to metal and rubber and toxic to fish at this concentration, so neutralize with 800 ppm sodium thiosulfate and rinse thoroughly with tap water or water from the next lake or river. Ensure that solution does not run-off directly into waterways.
Power wash with hot water	>104° F	20 min	Use appropriate PPE and caution when using hot water due to possibility of burns/scalding. Temperature and contact times are crucial, as efficiency is weather dependent. Most effective when used in conjunction with air drying (see below). Power wash with hot water, including thoroughly flushing lower motor unit.
Freezing	<32° F	24 hrs	Boats, gear, and equipment should be thoroughly frozen. Ambient air temperature should remain below freezing for the entire contact time. No safety precautions.
Air drying	N/A	3-5 days in hot sun 48 hrs in hot sun	Must dry completely to be effective. Most effective when used in conjunction with hot water (see above). To be used for small nets, gear, pumps, etc., *ONLY AFTER* power washing with hot (104°) water for appropriate contact time.
Salt Bath	1%	24 hrs	Due to the long contact time, may only be used as a bath solution and not sprayed. To be used only for pieces of equipment, gear, and nets that can be completely immersed in the solution.

Table 2. Disinfectant Amounts to Make Needed Concentrations

Disinfectant	1 gallon	2 gallons	5 gallons	20 gallons	100 gallons
100% Vinegar	1 gal	2 gal	5 gal	20 gal	100 gal
200 ppm Chlorine (household bleach, 5.25% Chlorine)	0.5 ounce (15 ml)	1.0 ounce (30 ml)	2.5 ounces (75 ml)	11.0 ounces (300 ml)	6 1/3 cups (1.5 L)
200 ppm Chlorine (HTH granular)	0.04 ounce (1.2 g)	0.08 ounce (2.4 g)	0.2 ounce (6 g)	0.8 ounce (24 g)	4.2 ounces (120 g)
800 ppm Sodium Thiosulfate	0.1 ounce (3 g)	0.2 ounce (6 g)	0.5 ounce (15 g)	2.1 ounces (60 g)	10.6 ounces (300 g)
1% Salt Bath (as NaCl)	1/8 cup	1/4 cup	2/3 cup	2 2/3 cups	13 1/3 cups

Notes:

1. Air drying and hot water are most effective when used in conjunction with each other because their effectiveness is highly dependent upon ambient temperatures and contact times. As needed, hot water wash units should be made available at selected Department facilities.
2. Household bleach (5.25% chlorine) and vinegar can be purchased from grocery or convenience stores. HTH granular chlorine (70% calcium hypochlorite) and Sodium Thiosulfate can be purchased at pool supply stores or chemical companies.
3. All bilges and hidden areas under boat decks must be thoroughly treated as described above.
4. Source: WI DNR (2007) *Equipment Disinfection Protocol for Invasive Species and Viruses.*

Table 3. Hatchery/Fish/Aquatic Organism Zebra Mussel Treatments and Usage Guidelines

Treatment	Concentration	Contact Time	Usage Guidelines/Comments
NaCl	20,000 ppm	2 hrs	Used for striped bass only. Treatment conducted during transport.
KCl/formalin	750 ppm KCl 25 ppm formalin	1 hr 2 hrs	Used for all other fish species and eggs. Fish and hauling water are pretreated for 1 hour with 750 ppm KCl, followed by a 2 hour treatment with 25 ppm formalin during transport. *DO NOT* treat fish with NaCl to counteract shock, as this decreases the effectiveness of the treatment.

Notes:

1. All fish, including those used in aquaria at nature centers, fairs, etc., are to be treated for zebra mussels while in transit.
2. Treatment concentrations and contact times that are currently exceeded during normal aquaculture operations (e.g., egg hardening and shipping) should be considered effective.
3. Some species or life stages of fish or other aquatic organisms may be less tolerant of chemical treatments. For these species or life stages whose chemical tolerances are unknown, bioassays must be performed prior to large scale use of the treatments listed above.
4. For species with known intolerances to recommended zebra mussel treatments, modifications of hatchery assignments, increased use of well water, UV treatment, sand filtration, and other system modifications or treatment/avoidance measures may be needed and should be considered on a case-by-case basis with the involvement and approval of Division Chiefs and the Invasive Species Coordinator.
5. Sources: IA DNR *Fairport Fish Hatchery ANS-HACCP*, Edwards *et al.* 2000.

Appendix. Attachment 2. Fish Transfer Information Sheet

(Submit via email at least 3 days prior to shipment)

Today's date:

Anticipated shipment date:

From: ☐ Blind Pony ☐ Chesapeake ☐ Hunnewell ☐ Indian Trail ☐ Lost Valley ☐ Paho ☐ Other:

To: ☐ Blind Pony ☐ Chesapeake ☐ Hunnewell ☐ Indian Trail ☐ Lost Valley ☐ Paho ☐ Other:

Species: Age: ☐ Eggs ☐ Fry ☐ Fingerling ☐ Adults

Lot Designation: From Rearing unit:

Lot History

Mortality record for last 15 days provided (see page 2)? ☐ Yes ☐ No
Fish will be taken off feed 24 hours prior to shipment? ☐ Yes ☐ No
Fish were last on the following water source: ☐ Spring ☐ Surface ☐ U/V treated ☐ Well water

The following aquatic nuisance species occur in this hatchery's watershed or the site of fish collection:
☐ Zebra mussels ☐ Parasitic copepods ☐ Rusty crayfish ☐ Quagga mussels
☐ New Zealand mud snails ☐ Other:

General Health within last 30 days: ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Unknown
(Basis of this classification: ☐ Mortality records ☐ Observation/feed intake ☐ Necropsy: gills, skin, organs)

If fair or poor: what problems were observed or suspected?
Any chronic problems?

Please complete the attached form

Therapeutic Used in last 30 days	Yes √	Date Treated	Why treated?	Results or Comments (cured problem; partial, little or no improvement)
None	☐			
Aquaflor	☐			
Copper sulfate	☐			
Formalin	☐			
Iodine	☐			
Immersion OTC	☐			
MS-222	☐			
Oxytetracycline	☐			
Perox-Aid®	☐			
Potassium permanganate	☐			
Potassium chloride (KCl)	☐			
Romet	☐			
Salt- NaCl	☐			
Vaccine (specify)	☐			
Other (specify)	☐			

Mortality Record Previous 15 days

Date Month	Day	Daily Mortalities

Appendix. Attachment 3. Disinfectants for aquaculture use.

Products	Use/supplier	Contact Time/product	Cost
General Methods			
Hot water-power wash	General cleaning		
Steam clean	General cleaning	5 minutes	
Chemical Treatments			
750 ppm KCl, 25 ppm Formalin	Zebra mussel prevention	KCl-1 hr, then add formalin-2 hrs = total time of 3 hrs	
Virkon® Aquatic	Western Chemical		10 lb tub= $92 10 lb (4)=$328
0.5%	General use,clothing, inside hauling tanks, equip., vehicles	10-30 min.	
1.0%	Foot bath	10 min.	replenish/check q 4 days
2%	Vaccination equipment	5 min.-then rinse with water	
Argentyne, Ovadine® 50-100 ppm	Egg disinfection Argent,Western Chemical	30 min-water hardening; 10 min. after water hardening (eyed eggs)	1 gallon Ovadine® $25.95
1.75% Iodine	Fish Farms (hard surfaces only) Western Chemical	corrosive to metal, nets, stains, detoxify with sodium thiosulfate	$100/ 5 gallons +shipping
Sodium hypochlorite (household bleach)	General cleaning	corrosive to metal, toxic to fish unless detoxified with sodium thiosulfate	
200 ppm	vehicles	1 hour	
500 ppm	laboratory-counters/floors	10 min-1 hour	
Sodium thiosulfate	De-toxify chlorine	grams thiosulfate= 2.85 x grams chlorine used	
Monitoring supplies			
Chlorine test strips	HACH	0-600 mg/l Cl2 #2890200	q=100 $17.40
	Fisher	0-200 ppm #22-479-808	q=200 $5.15
Iodine test strips	Fisher	0-100 ppm #22-307-863	q=200 $5.15
Virkon® S test strip	Western Chemical-Antec International	see www/wchemical.com	$6.95, also provided free with each case of Virkon®